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DEVELOPMENT OF PERSONALITY TESTS FOR NAVAL OFFICER SELECTION

I. ANALYSIS OF U. S. NAVAL ACADEMY CRITERION OF APTITUDE FOR SERVICE

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and

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Development of Personality Tests for Naval Officer Selection

I. Analysis of U. S. Naval Academy Criterion of Aptitude for Service

A B S T R A C T

The objective of this research is the development of personality measures to supplement the more scholastically oriented aptitude tests used in the selection of Naval officers. The first year's work, recently completed, was concerned with a study of associates' and officers' ratings of U. S. Naval Academy midshipmen on "aptitude for service," or leadership potential. Intercorrelations were computed among aptitude for service ratings for three summer cruises and two academic periods, standings in academic courses, and scholastic aptitude test scores, using 633 members of the class of 1951. Results indicated that the aptitude ratings were quite clearly differentiated from academic standing, and from verbal, mathematical, and spatial ability. Considerable stability was found in the ratings from one marking period to another, except for cruise ratings.

A more detailed analysis of the ratings given and received by about 200 midshipmen from the larger group indicated that the composite ratings by fellow midshipmen were highly reliable. There was some evidence indicating a slight tendency for raters who agreed with composite opinion in judging their associates, to stand high themselves in aptitude for service. Little or no relationship was found between aptitude for service and a number of biographical factors such as age, previous military service, amount and type of previous education, etc.

On the basis of the first year's work, it was felt that the aptitude ratings represented a suitable first criterion, and hence it was considered advisable and worth-while to proceed with the development and initial validation of personality measures to predict this criterion. This constitutes the objective of the second phase of the investigation which was recently initiated. Work is underway on the development of personality tests deemed to be most appropriate or promising in the light of what has been learned about the aptitude ratings during the first phase of the research.

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I. INTRODUCTION

A. Background and statement of problem

In the selection of future Naval officers for midshipmen training at the United States Naval Academy, the mental qualifications of prospective midshipmen are evaluated through a consideration of previous academic record, and through the use of a scholastic aptitude test. In addition, a great many applicants are required to take entrance examinations revealing proficiency in various school subjects. It is recognized, of course, that, to be successful, future Naval officers must possess not only the necessary intellectual qualities for acquiring proficiency in various required skills and fields of knowledge, but also those characteristics of personality, temperament, and motivation which are conducive to effective functioning as leaders in the Naval Service. The objective of the research reported here is the development of personality measures which are capable of revealing such characteristics, and which are useful, therefore, as techniques for supplementing the more scholastically oriented aptitude tests used in the selection of Naval officers.

The investigation was undertaken within the setting of the Naval Academy for several reasons. Midshipmen represent a rather homogeneous group insofar as their required duties and general activities are concerned so that they may be observed within a fairly uniform behavior setting. Also, midshipmen are rated frequently by both their officers and fellow students on over-all leadership potential, or "aptitude for service," which the Naval Academy considers an extremely important variable in midshipman evaluation. In planning the project it was felt, therefore, that it would be well to direct this research first of all toward an analysis of the aptitude for service ratings at the Academy, with a view to studying their underlying components, their relationships to other variables, and their over-all suitability as criterion

measures. If favorable results were obtained in this portion of the study, then the second phase of the investigation would be directed toward the development of personality tests for use in the prediction of aptitude for service. The present report describes and presents the results of the first major phase of the research, which was concerned with a detailed study of the aptitude for service ratings used at the Naval Academy.

B. Description of aptitude rating system at Naval Academy

A brief description of the system for rating midshipmen in aptitude for service, or leadership potential, follows. The student body is organized in military fashion into 36 companies, each of which consists of first, second, third and fourth classmen, or seniors, juniors, sophomores, and freshmen, respectively. Each midshipman is rated by those fellow midshipmen in his company who are in his class and in the classes above him. At the same time, midshipmen are rated by Executive Department company officers, who consider in their ratings any observations reported to them by other executive officers or Academic Department instructors. Ratings are made near the end of each academic term and summer training period. Using a 0 to 4.0 scale, ratings are made on four designated categories, or groups of traits: performance of duty, attitude, bearing and dress, and service desirability, the last representing an over-all estimate of the ratee's potential value as a Naval officer.

The points indicated for consideration by the rater in each of these categories are as follows:

Performance of duty

Is he industrious, reliable, forceful? Does he exercise good judgment? Does he have initiative? Does he carry through in

spite of obstacles? Does he understand instructions? Does he use helpful suggestions?

Attitude

Does he really want to make the Navy or Marine Corps his career? Does he work well with his classmates, seniors and juniors? Is he proud of the Naval Academy and the Service? Does he adapt himself easily to changed conditions? Is he honest? Respectful? Loyal? Tactful?

Bearing and Dress

Does he wear his uniform with pride? Is he clean and neat of person and dress? Does he have good posture? Does he have good manners? Are his movements well coordinated? Is he alert?

Service Desirability

Considering the requirements of the Service, estimate the value of this midshipman to the Service as a junior officer. Does he accept responsibility readily? Can he be depended upon to carry out his job to the limit of his ability? How would you like to have him under your command?

To supplement the numerical ratings on these four categories, raters are encouraged to write descriptive remarks or comments about each individual on the IBM card on which the ratings are recorded.

The average ratings received from fellow midshipmen for each of the four categories mentioned above constitute an individual's Midshipmen Composite Marks. These four marks are then averaged to form his Midshipmen Composite Average Mark. Similarly, the ratings assigned by the Executive Department

company officer constitute the midshipman's four Executive Composite Marks, which are also averaged to yield an Executive Composite Average Mark. Midshipmen Composite and Executive Composite Marks are averaged separate, for the four categories and for the over-all mark. This last figure, or Trial Mark, is then converted to a Final Mark so as to yield within each battalion consisting of 6 companies, an approximately normal distribution for each class with a mean of 3.2 and a standard deviation of about .24. This Final Mark in aptitude for service is then entered into a midshipman's record along with his other marks, at the end of each academic term and summer training period. It should be pointed out that the procedures for obtaining summer cruise ratings are somewhat different from the more or less uniform ones which prevail during the academic year, as will be described in a later section.

The importance to the midshipman of the ratings he receives in aptitude is reflected in a number of ways. At the end of each term, any individual who has a Trial Mark below 2.5 on any of the four categories must appear before the Aptitude Board, which reviews his record in aptitude for service, and makes appropriate recommendations to the Commandant of Midshipmen concerning whether the man should be passed, placed on probation, or discharged for inaptitude. Also, at the end of each term the company executive officer interviews each midshipman to discuss his standing in aptitude for service, starting with those midshipmen who stand lowest in the company. Excerpts from the remarks made by other midshipmen are read to him, in order to point out his shortcomings and to help him to overcome them. Judging from the extremely blunt nature of many of the critical remarks made, it seems likely that this interview may be a rather disturbing, even though enlightening, experience for some midshipmen.

Another illustration of the importance to the individual of his standing on aptitude, is the fact that the appointments to midshipmen officer positions within the Midshipmen Brigade depend to a large extent on the aptitude mark. In senior year, the man with top aptitude standing is generally the most likely candidate for Midshipmen Brigade Commander, a post for which there is much competition. Further indication of the importance of aptitude standing is the weight it is given, particularly in senior year, in determining over-all standing in the class. In 1949-1950, for example, aptitude for service was weighted more heavily than any single course in determining over-all standing for the senior year.

II. PROCEDURES AND RESULTS

The analysis of the Naval Academy's aptitude for service ratings consisted of two major parts. The first, based on a large sample, 633 members of the class of 1951, involved the determination of interrelationships among various aptitude for service ratings, standings in conduct and in academic courses, and scholastic aptitude test scores, 41 variables in all. The second major part of the analysis, based on a small sample, slightly over 200 midshipmen taken from the large sample, was concerned with a more detailed analysis of certain aspects of the ratings, and with the relationships between biographical factors and aptitude for service.

A. Large sample (633 members of class of 1951)

Product-moment correlations were computed among the 41 variables listed in detail in the left-hand column of Table A, Appendix, containing the obtained coefficients of correlation. The variables included in the analysis may be grouped and described briefly as follows:

Average for service ratings by fellow midshipmen and by officers

Academic periods

First term, 2nd class (junior) year, January 1950

Second term, 3rd class (sophomore) year, May 1949

Summer cruises

First class (senior) cruise, 1950

Second class (junior) cruise, 1949

Third class (sophomore) cruise, 1948

(In the case of the January 1950 and summer 1949 ratings only, all four categories, i.e., performance of duty, attitude, bearing and dress, and service desirability, were included along with their averages.)

Class standing in conduct and in courses

Second class (junior) year, 1949-1950

Conduct - standing based upon number of demerits

Leadership course

Third class (sophomore) year, 1948-1949

Marine Engineering

Mathematics

Electrical Engineering

History

Foreign Language

Physical Training

Tests administered in fourth class (freshman) summer, 1947

College Board Scholastic Aptitude Test, Verbal

College Board Scholastic Aptitude Test, Mathematics

College Board Spatial Relations Test

1. Relationships with other variables

The intercorrelations obtained among the variables included in the present analysis reveal a number of interesting findings concerning the aptitude ratings. As indicated in Table A, Appendix, it is clear that the aptitude or service ratings represent midshipmen attributes which are quite different from those characteristics that are reflected in academic course grades (correlations mainly below +.15), and in scholastic aptitude tests (correlations from -.09 to +.08). By comparison, the various aptitude ratings were themselves clustered together to rather marked degree. Generally similar results were obtained in a recent study (1) of military adaptability ratings of Coast Guard cadets.

There was some evidence found for a very slight relationship between aptitude ratings and marks achieved in physical training, the correlations ranging from +.10 to +.30. A similar slight relationship appeared between aptitude ratings and class standing in conduct. In connection with the low but consistently positive correlations obtained between aptitude ratings and physical training marks, it should be mentioned that equally high or higher correlations were obtained in studies (4, 6) conducted at West Point by the Personnel Research Section, Adjutant General's Office, Department of the Army, between similar aptitude ratings and various single objective physical efficiency tests, such as running 150 yards, broad jumping, execution of dips on parallel bars, etc. Various combinations of four or five such tests yielded multiple correlations with aptitude ratings in the low .50's, two cross-validations resulting in shrinkages of .08 and .04. These findings indicate the potential promise of small batteries of physical proficiency tests in the prediction of aptitude ratings, and strengthen the significance of the low positive correlations found in the present study between aptitude ratings and physical training marks which represented a one year

is based largely upon rated over-all performance on four tests: swimming, personal defense, agility (obstacle course), and applied strength.

A point of further interest revealed in Table A, Appendix, is that the correlations between aptitude ratings and a course in the principles of leadership were, for the most part, no higher than those between aptitude ratings and other academic courses.

Another question which, it was felt, warranted investigation, was the possibility that relationships might exist between the attributes represented by the aptitude ratings, and verbal ability-spatial ability discrepancies. As pointed out by Thurstone (2), a number of studies have shown some indication that there may be temperamental differences between individuals who are relatively higher in verbal than in spatial ability and those who are relatively higher in spatial than in verbal ability. In the present study, mean aptitude ratings were determined for midshipmen falling in the various cells in scatter plots between verbal and spatial test scores. No meaningful trends were revealed by this analysis to support the notion that relative superiority in verbal or in spatial ability was related to aptitude standing.

2. Differentiation among four categories of aptitude for service

Insofar as the interrelationships among the various aptitude ratings themselves are concerned, one of the most emphatic findings coming out of the present analysis was that there was virtually no differentiation among the four categories on which aptitude for service ratings were made, i.e., performance of duty, attitude, bearing and dress, and service desirability. Table 1 presents the intercorrelations among these four variables, separately for Midshipmen and Executive Composite marks for both January 1950 and cruise 1949. It

is evident that neither the midshipman nor the officers differentiated among the four categories to any appreciable degree, but rather tended to rate a man at about the same level on the four scales. This conclusion is further strengthened by the results obtained, in the case of the January 1950 Midshipmen Composite ratings, when the intercorrelations were corrected for attenuation. As indicated in Table 1, when thus corrected, these intercorrelations became unity, or extremely close to unity. There is some indication in Table 1 that the bearing and dress category was differentiated from the other categories to a very slight extent, particularly by officers.

Table 1

Intercorrelations among 4 Categories of Attitude for Service Ratings by Midshipmen and by Executive Officers, for January 1950 and Cruise 1949.
(Class of 1951, U. S. Naval Academy. N = 633)

Period	Raters	Cate-gories	Categories			
			Performance of Duty 1	Attitude 2	Bearing and Dress 3	Service Desirability 4
First Term, 2/c year	Midshipmen	1		.92(1.00)*	.92(1.00)	.94(1.02)
		2			.89(.97)	.93(1.02)
		3				.91(.98)
		4				
	Executive Officers	1		.88	.83	.90
		2			.78	.88
		3				.82
		4				
Cruise 1949	Midshipmen	1		.87	.87	.88
		2			.83	.87
		3				.85
		4				
	Executive Officers	1		.86	.74	.90
		2			.64	.92
		3				.80
		4				

*Correlations in parentheses have been corrected for attenuation, with reliabilities estimated using 238 cases from above sample. (See page 15.)

Table 2

Correlations between Midshipmen Composite and Executive Composite Ratings
 (Average of 4 Categories) in Aptitude for Service for 5 Different Periods.
 (Class of 1951, U. S. Naval Academy.)

Period				
Academic Year		Summer Training Period		
First term, 2/c year Jan. 1950	Second term, 3/c year May 1949	1/c Cruise 1950	2/c Cruise 1949	3/c Cruise 1948
.77 (N=633)	.75 (N=633)	.47 (N=621)	.66 (N=633)	.38 (N=633)

3. Comparison of midshipmen and officer ratings

Another important consideration in the analysis of the aptitude ratings is the relationship between ratings given by officers and those given by fellow midshipmen. Table 2 contains the correlations between Midshipmen Composite and Executive Composite ratings for each of five different rating occasions over a two-year period. Correlations are shown only for the averages of the four categories. It is apparent that there was substantial agreement between ratings made by midshipmen and by officers for ratings made during the academic year and during the 1949 summer cruise. At the same time, however, it is clear that officers and midshipmen were not rating in an entirely identical fashion. The officer-midshipmen agreement was considerably lower for the cruise ratings, particularly the 1948 and 1950 cruises, than it was for ratings made during the academic year.

At this point, several factors need to be mentioned which have a bearing on the interpretation of the results presented both in Table 2 and in Table 3, containing correlations of ratings made at different periods. First, midship-

men duties and activities on summer training cruises are quite different from those that prevail during the academic year, and involve work of a much more specialized, practical nature associated with ship operation and maintenance; hence it is quite plausible that officers and fellow midshipmen might differ to a greater extent in the cruise ratings. Second, the Executive Composite cruise ratings were rather strongly determined by ratings made by ship's officers, whose ratings are very likely to differ from those made by Academy officers. It is conceivable, for instance, that ship's officers might put considerably less emphasis on bearing and dress than Naval Academy officers might. Third, the Midshipmen Composite ratings for the 1948 and 1950 cruises contained ratings by ROTC midshipmen from civilian colleges who also participated in the cruise training. Fourth, the Midshipmen Composite cruise ratings were based on fewer judges than those made during the academic year, and are less reliable. The particularly low officer-midshipmen agreement (.36) for the 1948 cruise, which took place at the end of the freshman year, might be due to the fact that on that cruise the midshipmen in this study were rated only by first classmen, whereas on the 1950 cruise they were rated by fellow classmen who knew them better. It should be pointed out here that the factors mentioned above indicating cruise vs. academic year differences, apply much less to the 1949 cruise than to the other two cruises. Compared with their activities on the 1948 and 1950 cruises, during the summer of 1949 the midshipmen in this study spent considerably less time on task force ships, and more time at the Naval Academy and on air cruises or visits to Naval flying facilities under the direct supervision of Academy officers. Hence one might expect that officer and midshipmen ratings for the 1949 summer would agree more closely than those for the other two summers.

Table 3

Correlations among Aptitude for Service Ratings Made at Different Times, and Correlations of Cruise Ratings with Ratings Made During Academic Year. (Class of 1951, U. S. Naval Academy. N = 633, except for correlations involving Cruise 1950 ratings, where N = 621.)

Comparisons		Months be- tween ratings	Aptitude Ratings	
			Midshipmen Composite	Executives Composite
Academic vs. Academic	Jan. 1950: vs. May 1949	(8)	.81	.67
Cruise	Cruise 1950: vs. Jan. 1950 vs. May 1949	(7) (15)	.51 .48	.25 .27
	Cruise 1949: vs. Jan. 1950 vs. May 1949	(5) (3)	.65 .62	.49 .44
Academic	Cruise 1948: vs. Jan. 1950 vs. May 1949	(17) (9)	.52 .57	.29 .36
Cruise	Cruise 1950: vs. Cruise 1949	(12)	.48	.21
	Cruise 1950: vs. Cruise 1948	(24)	.42	.16
Cruise	Cruise 1949: vs. Cruise 1948	(12)	.55	.23

4. Stability of ratings, and comparison of cruise vs. academic year ratings

Table 3 presents correlations indicating the stability of the aptitude ratings both for two different academic periods, and for three successive summer cruises. At the same time, correlations are presented indicating the degree of similarity between cruise ratings and ratings made during the academic year. The approximate number of months between ratings compared is also indicated.

It is evident that Midshipmen Composite ratings were considerably more stable from one marking period to another than were the Executive Composite rat-

ings, both when the two academic periods are compared, and when the three cruises are considered. The greatest stability was found for the ratings made for the two academic periods, where the obtained correlations were .81 for midshipmen ratings, and .67 for officer ratings. On the other hand, the stability of the cruise ratings was found to be a good deal lower, particularly for the Executive Composite ratings, for which the three cruise vs. cruise correlations were only .21, .16, and .23.

The generally superior stability of the midshipmen ratings is probably attributable largely to the fact that they were based on many more judges than was the case for the officer ratings, which frequently represented mainly the judgement of one rater. Probably contributing to the low stability of the officer cruise ratings from summer to summer is the fact that for the most part, different officers' ratings were involved in the three cruise ratings. In connection with a similar problem, an opportunity was available to compare the stability of the Executive Composite ratings for the two academic periods when the company officers making the ratings were the same on the two occasions, with the stability obtained when the company officers were different on the two occasions. Surprisingly, virtually no difference in stability was found, the correlations between Executive Composite ratings made in January 1950 and those made in May 1949 being .698 for 234 midshipmen rated by the same officer, and .683 for 399 midshipmen who were rated by different officers.

In comparing aptitude ratings based upon cruise behavior with ratings based upon behavior during the academic year, the findings presented in Table 3 indicate that the two sets of ratings had a good deal in common, but nevertheless somewhat different factors seemed to be involved in the two situations. Again, midshipmen ratings showed consistently higher agreement from one marking period to another than did the officer ratings. It may be noted in Table 3

that the 1949 cruise ratings were more highly correlated with the two academic year ratings than with the other two cruises. This finding can be considered as evidence of the fact mentioned previously, that insofar as factors likely to influence the ratings are concerned, the 1949 cruise in several ways differed from the academic year to a lesser extent than did the 1948 and 1950 cruises. An added consideration in connection with the above finding might be, of course, that the 1949 cruise ratings were considerably closer in time to the academic ratings than they were to the other cruise ratings. However, the influence of elapsed time between ratings upon the obtained correlations is extremely difficult to evaluate independently of other factors already discussed, so that no clear-cut conclusions in this regard appear warranted.

5. Inter-individual differentiation by midshipmen and by officers

One other finding of considerable interest and importance revealed by the analysis of the large sample data is that for each marking period, the variability of the Executive Composite ratings assigned to the group under study was consistently greater than that of the Midshipmen Composite ratings, in the ratio of approximately 3 to 2. This means that if a simple average of the two kinds of ratings were to be computed, the officer ratings would actually receive approximately one and one-half times as much weight as the midshipmen ratings.

B. Small sample (slightly over 200 midshipmen included in large sample)

The second part of the analysis of the aptitude for service ratings was concerned with a more detailed study of the January 1950 ratings, for the purpose of investigating the reliability of the Midshipmen Composite ratings, certain features of the ratings made by midshipmen raters, and the relationship between biographical factors and aptitude ratings. A sample of slightly over 200 midshipmen included in the large sample, was utilized in this part of the

study. These men presented the second classmen included in 12 of the 36 companies constituting the entire midshipmen brigade, with two companies being represented from each of the six battalions. Each man in this sample was rated by approximately 18 fellow second classmen and by a similar number of first classmen in his company. Each man, in turn, rated his fellow second classmen. All of these data were assembled for the midshipmen in this small sample, and a number of analyses were completed utilizing this material.

1. Reliability of Midshipmen Composite ratings

Reliability estimates for the Midshipmen Composite ratings on each of the four categories of aptitude for service were obtained by correlating, for 238 cases, the average ratings assigned by equivalent halves of the total number of about 40 raters. The results indicated that the Midshipmen Composite ratings were highly reliable, corrected reliabilities for the four categories being: performance of duty, .92; attitude, .91; bearing and dress, .93; and service desirability, .92. Since the number of raters contributing to the composite was so large in this case, it was felt that estimates of the average intercorrelation between pairs of raters would be a valuable additional index of rater agreement. These average intercorrelations for the four categories were found to be .25, .21, .27, and .24, respectively. A further breakdown to compare the agreement among first classmen raters with that among second classmen raters within each company, indicated a slight tendency for the upper classmen to agree with one another to a greater extent than did second classmen themselves. Considerable variation in rater agreement was found, also, from company to company. In rating attitude, for example, average ratings made by about ten 2nd classmen correlated with average ratings by ten other 2nd classmen to the extent of .47 in one company, while in another company the agreement be-

tween ratings made by two similar groups of second classmen was .89. Such differences might possibly reflect company differences in the instructions and orientation given to raters, or in the manner in which ratings were made.

2. Comparison of properties of ratings given with ratings received

A problem of particular interest in the analysis of the ratings, was the question of whether relationships might be found between an individual's own aptitude for service and various aspects of the manner in which he rates other midshipmen. Consequently, ratings made by second class midshipmen in judging the aptitude of fellow midshipmen, for performance of duty only, were analyzed so as to secure for each individual four measures reflecting certain properties of the ratings made by him. These measures, which appear as the first four variables in Table 4, were the following: 1) the mean rating assigned by the rater to other second classmen; 2) the standard deviation of the ratings assigned by him; 3) the agreement (correlation) between the rater's judgments and composite ratings made by fellow midshipmen; and 4) a measure of the rater's tendency to distinguish among the four categories of aptitude for service, obtained by averaging, over all men rated, the differences between the highest and lowest of the four ratings assigned to each man by the rater. The last three measures just described were included because it was felt that the midshipman rater who tried to differentiate widely among the better and poorer midshipmen, who agreed with composite opinion in making his judgments, and who attempted to differentiate among the four categories of aptitude for service, was perhaps a better than average rater who might himself stand high in aptitude for service. The four properties of ratings given by raters were correlated with raters' own standings in aptitude, in a leadership course, in conduct, and in verbal and mathematical scholastic aptitude test scores. Inter-correlations among these variables for 207 midshipmen in the small sample are presented in Table 4.

Table 4

Intercorrelations among Properties of Aptitude for Service Ratings Given to Associates, Aptitude for Service Ratings Received from Associates, Class Standings in Leadership Course and in Conduct, and Scholastic Aptitude Test Scores.
(Class of 1951, U. S. Naval Academy. N = 207)

Variables		Properties of Ratings Given				Aptitude Ratings Received				Class Standings		Test Scores		
		1	2	3	4	5	6	7	8	9	10	11	12	
Properties of Ratings Given*	Mean rating assigned by rater	1		-.08	-.01	.17	-.09	-.13	-.04	-.05	-.02	-.03	-.04	-.07
	c of ratings assigned by rater	2	-.08		.00	.38	-.07	-.08	-.07	-.09	-.01	-.08	-.01	.07
	Rater's agreement with composite**	3	-.01	.00		.02	.23	.22	.22	.21	.07	.14	.03	.07
	Rater's differentiation among 4 categories***	4	-.17	.38	.02		.57	.09	.06	.10	.10	.01	-.02	.03
Aptitude Ratings Received	Midshipmen Composite (Average), January 1950	5	-.09	-.07	.23	.07		.78	.72	.54	.22	.31	-.03	-.06
	Executive Composite (Average), January 1950	6	-.13	-.08	.22	.09	.78		.67	.52	.14	.29	-.03	.04
	Midshipmen Composite (Average), Cruise 1949	7	-.04	-.07	.22	.06	.72	.67		.59	.19	.27	-.05	-.02
	Executive Composite (Average), Cruise 1949	8	-.05	-.09	.21	.10	.54	.52	.59		.11	.30	-.09	-.02
Class Standings	Leadership Course 2nd class year, 1950	9	-.02	-.01	.07	.10	.22	.14	.19	.11		.06	.55	.24
	Conduct, 2nd class year, 1950	10	-.03	-.08	.14	.01	.31	.29	.27	.30	.06		.16	.06
Test Scores	Scholastic Aptitude Test Verbal, 1947	11	-.04	-.01	.08	.02	.03	.03	.05	.09	.15	.16		.32
	Scholastic Aptitude Test Math., 1947	12	-.07	.07	.07	.03	.00	.04	.02	.02	.24	.06		.32

Mean 3.23 .20 .67 .17 3.24 3.26 3.23 3.23 13.3 13.7 502 627
 σ .05 .07 .37 .09 .14 .23 .10 .19 3.6 4.0 77 67

*First 3 variables based on Performance of Duty ratings only.

**This variable consists of z transformations of correlations between raters' judgments and composite ratings.

***Mean difference, over all men rated, between highest and lowest of 4 ratings assigned to each man.

For samples drawn from normal populations, r 's of .19 or higher are significant at 1% level of confidence.

As indicated in Table 4, the mean and variability of the ratings assigned by a rater, and the degree to which he attempted to distinguish among the four categories of aptitude for service, were found to have no appreciable relation to the rater's own standing in aptitude. However, the results indicate that raters who agreed with Midshipmen Composite opinions in rating associates had a slight tendency to be rated high in aptitude themselves, both by officers and fellow midshipmen during summer training as well as during the academic year. This relationship is evidenced by the four correlations in the low .20's. Although this indicated trend is a very slight one, further investigation of the relationship between a man's standing in aptitude and various aspects of the manner in which he rates others, or discrepancies between self-ratings and ratings by others, would probably be very worthwhile.

It is interesting to note further in Table 4 that a moderately strong tendency was found for those persons who differentiated widely among individuals to also differentiate widely among the four categories of aptitude for service in rating each man, as indicated by an obtained correlation of .33 between these two variables. None of the characteristics of the ratings given by a midshipman to his associates were related to the rater's standing in a leadership course, in conduct, or in verbal and mathematical ability.

3. Relationship between aptitude ratings and various biographical factors

As one means of gaining some insight regarding the sorts of factors which might be entering into the aptitude for service ratings, it was decided to investigate the question of whether certain background or biographical characteristics might be related to midshipmen's aptitude for service, and to their effectiveness as raters of others. Hence, the individual files of the midshipmen in the small sample were examined at the Naval Academy, and data

were assembled for the sample of 207 cases on the following biographical factors, which are listed in Table 5: 1) parents' birthplace, whether native or foreign born; 2) age; 3) religion, whether Protestant or non-Protestant; 4) number of years of previous education; 5) type of previous education, i.e., whether a man had attended regular high schools, preparatory schools, or colleges before admission, on the one hand, or had had some schooling in special pre-Annapolis preparatory schools, or had participated in college NROTC, V-12, or other Naval training programs; 6) number of months prior military service; 7) number of hospital or sick-quarters admissions during the first three years at the Academy; 8) number of elective extracurricular positions held and 9) number of sports awards received during the first three years at Annapolis; 10) type of appointment to the Academy, whether Congressional appointment, in which case the element of competitive examinations is relatively not very great, or purely competitive appointment, such as the appointments made from the ranks of the Navy or by the President; 11) father's occupation, whether civilian or member of Armed Forces.

Product-moment correlations were computed* between these biographical factors and aptitude ratings by midshipmen and officers for January 1950 and summer cruise 1949. The obtained correlations, which are presented in Table 5, lead to the general conclusion that there was virtually no relationship between the various biographical variables studied and aptitude ratings. If one were to attach any meaning at all to those few correlations which were .18 or above,

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*Although five of the biographical variables were dichotomous, and several were continuous but markedly skewed, product-moment correlations were computed throughout. In the case of the dichotomous variables, the obtained r's are point-biserials, which are appropriate measures since for the most part the dichotomous variables can be considered basically point-distributed.

Table 5

Product-moment Correlations between Aptitude for Service Ratings and Various Biographical Factors
(Class of 1951, U. S. Naval Academy. N = 207)

Biographical Factors	Aptitude for Service Ratings			
	First Term, 2/c Year, January 1950		2/c Cruise, Summer 1949	
	Midshipmen Composite (Average)	Executive Composite (Average)	Midshipmen Composite (Average)	Executive Composite (Average)
Parents' Birthplace (both born in U. S.* vs. one or both foreign born)	-.05	-.09	-.03	-.05
Age (in 1/2 years)	.03	.10	.00	.04
Religion (Protestant* vs. non-Protestant)	.00	-.07	-.02	-.02
Amount of Previous Education (years of schooling prior to admission)	-.03	-.04	-.06	-.02
Type of Previous Education (regular* vs. special pre-Annapolis schooling)	.22	.15	.16	.05
Prior Military Service (number of months)	-.07	.04	-.04	.08
Hospital Admissions (no. of hospital or sick-quarters admissions, 1947-50)	-.05	-.05	.01	.06
Extra-curricular Activities (number of elective positions held, 1947-1950)	.14	.08	.12	.13
Sports Awards (no. of athletic numerals or letters awarded, 1947-1950)	.10	.07	.18	.09
Type of Appointment to USNA (Congressional* vs. purely competitive)	.20	.11	.05	-.04
Father's Occupation (civilian* vs. member of Armed Forces)	.19	.17	.10	.04

*Positive direction.

For samples drawn from normal populations, r's of .18 or higher are significant at 1% level of confidence. Since most of the above r's involved variables which were either dichotomous or considerably skewed, they would need to be higher than .18 for significance at the 1% level.

whatever trends are apparent indicated a very slight tendency for higher aptitude ratings to be associated with regular rather than special pre-Annapolis training, with number of sports awards received at the Academy, with Congressional-type appointment to the Academy, and with civilian, rather than military occupation of father. It should be stressed that these relationships were very small and of very questionable significance.

The general lack of relationship found between the various biographical factors investigated and a midshipman's standing on aptitude for service might be interpreted as having favorable or unfavorable implications, depending upon the nature of one's prior assumptions regarding the type of relationships that ought to exist. One might argue, for example, that the aptitude ratings should be free of influence by such biographical factors as parent's birthplace, age, religion, number of years prior schooling, etc., in which case the general absence of relationship found between aptitude ratings and such biographical factors would be considered gratifying. On the other hand, one might argue that the aptitude ratings probably ought to reflect such factors as previous military experience, and outstanding participation in extra-curricular activities and sports, in which case the obtained findings would be considered somewhat surprising.

It should be mentioned that no significant correlations were found between the various biographical factors studied and the four properties of aptitude ratings given by midshipmen to their associates, which were discussed in the preceding section.

4. Study of remarks accompanying ratings

In a further attempt to gain some understanding of components which might enter into the aptitude for service ratings, a study of the remarks ac-

companying the numerical ratings made by both midshipmen and officers was initiated, and is fairly close to completion. The comments made by about 36 raters in describing the top man and the lowest man in aptitude for service in each of the 12 companies making up our small sample, were transcribed from the original cards and broken down into their component descriptive statements or characteristics. With the objective of determining the relative frequency of occurrence of various sorts of observations included in the comments made by both first and second classmen in rating second classmen, an initial sorting of all the component statements or characteristics observed has been completed. A final classification of these remarks into appropriate categories, along with a determination of the relative frequencies in each category, will be the next step to be carried out. This particular analysis has already proved to be quite revealing and helpful in indicating a great many characteristics which apparently are considered important by raters, or which are uppermost in their minds, in the sense that they are found to occur most frequently among the many remarks made. For example, by far the most frequently occurring remarks were those commenting on midshipmen's bearing and dress. In general, it appears as though the more frequent sorts of remarks made pertain to those characteristics mentioned on the back of the rating card, i.e., the man is said to be adaptable, reliable, conscientious, honest, to have initiative, to cooperate well with others, to want to make the Navy a career, etc. On the other hand, occurring with less frequency are a good many revealing, more specific sorts of observations, which one might reasonably feel are probably reflective of important components of leadership potential or aptitude for service. To illustrate, the following observations, in the vernacular, appear on cards presently grouped in one particular category: "impartial in dealings with others," "a little off the beaten track with respect to the rights of others,"

"has sense of fair play," "commanding through his fairness to all." In another group of cards are the following: "has tendency to grumble and cause discontent," "given to criticism of authority and regimentation"; in still another: "is very hard headed and doubts the most obvious things," "narrow minded in his ideas and will not hear the views of others," "is too certain of himself at times, which antagonizes others," "is firm but not overbearing."

Although it may be somewhat premature to make generalizations from this portion of the investigation, the study of the observations made by raters, led to the hypothesis that at least two of the main, rather broad, components underlying the aptitude ratings are these: First, the possession of a pleasant, congenial, attractive personality, with the capacity and desire to establish warm relationships with other midshipmen, and to be accepted by them. This is not a very startling conclusion, and has been pointed out by a number of people working with ratings of this sort. However, it was quite gratifying to find that apparently the midshipmen seemed to be reflecting in their ratings something more than simply the personal attractiveness or popularity of the men they were rating. That is to say, they did make observations regarding a number of important characteristics of the manner in which a man carried out his assignments, his willingness to cooperate and contribute in group efforts, his interest in helping underclassmen, etc. Underlying all of these and many other observations, it is felt, and mentioned very frequently as a separate comment, is the second hypothesized major component influencing the ratings a midshipman will receive, i.e., his acceptance of the system of regimentation and way of life which prevail during the four years of training at the Naval Academy, and his willingness to work within this system. Closely tied up with this component are such specific factors as his attitude toward the Naval Service and the strength of his desire to make the Navy a career. Insofar as the prediction problem is concerned,

a probable difficulty is the fact that no matter how strong prospective midshipmen's desires to have service careers may be before entering the Naval Academy, it is certainly likely that the attitudes of some may change after they have been midshipmen for some time. One of the essential problems, then, it is felt, is to attempt to predict whether an individual will react positively or negatively to the rather unfamiliar, and conformity-demanding environment of the Naval Academy, since his aptitude ratings will to a considerable extent depend upon this reaction and its consequent attitudes.

III. Conclusions

It would be well to appraise briefly the over-all results of the research reported here, in terms of the stated objectives of this phase of the investigation. Some hypotheses have been developed concerning the sorts of underlying psychological components which might enter into the aptitude ratings, and it appears as though they reflect considerably more than simply pleasantness of personality, or popularity. A considerable amount has been learned about the relationships between aptitude for service ratings and a number of other variables. The correlational analysis indicated that the ratings represent an entity which is quite clearly differentiated from course grades and from verbal, spatial, or mathematical ability. In addition, the ratings were found to be quite free of influence from a variety of biographical factors such as age, religion, birthplace of parents, or amount of previous schooling; they were also found to be virtually unrelated to several biographical variables which one might have expected to correlate with them, e.g., prior military service, regular or special pre-Annapolis training, or number of elective positions held in extra-curricular activities. Some indication was found, also, that the tendency to rate one's associates in a manner which closely agrees with the group opinions on these men, was itself related slightly to aptitude standing.

The reliability of the aptitude ratings appears reasonably good, particularly in the case of the midshipmen ratings, and in the case of both officer and midshipmen ratings made during the academic year. Officer ratings made on the various cruises, on the other hand, show very little stability from cruise to cruise.

On the basis of the general findings summarized above, it was concluded that the aptitude ratings possess many of the desired attributes of a suitable criterion. Unfortunately, the validity of the ratings as measures of leadership potential, or as predictors of the ultimate effectiveness of Naval officers as leaders, has not been established empirically as yet, although several studies have given some indication that ratings of this sort can be predictive of post-training military performance.* In this broad sense, then, the aptitude ratings are admittedly interim criteria; however, they represent an entity which is highly valued in itself at the Naval Academy and is considered an important training objective that includes elements which are important for later success in the Naval Service. Empirical studies to determine the degree to which aptitude standing at the Academy is related to subsequent officer performance are necessary, of course, and it has been indicated to the authors that such studies

*A recent follow-up study (5) of West Point cadets indicated that aptitude for service ratings very similar to those investigated in the present research constituted the best predictor of subsequent officer success for both Combat Arms and Technical Service officers. An earlier study (3) of Marine Corps officers indicated that the most valid predictor of combat performance was a composite rating by associates in pre-OCS training, on all-round officer ability.

are to be carried out. Studies of this sort would serve as a basis for evaluating the aptitude ratings, and for suggesting appropriate modifications in them, if such are necessary.

In view of the results of the present study indicating that aptitude ratings represent an independent measure of highly valued midshipman characteristics possessing reasonably good reliability, and in view of the confidence placed upon the ratings as a measure of future military leadership, it was concluded that standing in aptitude for service at the Naval Academy might legitimately be considered an appropriate criterion, at least for the present. It was therefore considered advisable to proceed with the development and initial validation of personality measures to aid in the prediction of aptitude for service, making maximum use of what has been learned about this criterion during the first phase of the research. This constitutes the objective of the second phase of the investigation, which was recently initiated.

Intercorrelations Among Aptitude for Service Ratings by Executive Officers and Fellow Midshipmen, Class Standing in Courses and Conduct, and Scholastic Aptitude Test Scores. Class of 1955

($N = 63$) except for variables 15, 26, 31, and 32 where $N = 61$.

Variables		Variable Number	Attitude for Service Rating																Score T					
			Academic Year										1st term 2/c year Jan. 1950						2nd term 1/c year May 1950					
			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	
Highly Motivated Composite	Performance of Duty	1	92	92	92	92	92	78	72	70	73	77	88	79	63	75	50	29	62	63	60	62	62	
	Attitude	2	92	89	93	92	74	73	70	73	71	77	88	79	67	74	50	27	61	68	59	62	62	
	Bearing and Dress	3	92	89	91	72	72	70	74	71	76	87	80	68	72	49	27	62	62	64	62	62		
	Service Desirability	4	94	93	91	92	75	72	70	73	76	88	80	68	73	52	28	62	63	61	64	63		
	Average of 1-4	5	96	95	94	96	75	72	72	74	77	85	81	68	75	51	27	62	64	61	63	65		
Executive Composite	Performance of Duty	6	74	75	72	75	75	88	83	80	86	92	92	66	62	67	50	26	56	56	53	54	57	
	Attitude	7	72	73	70	72	72	88	72	88	76	90	90	65	60	64	35	21	52	54	49	49	52	
	Bearing and Dress	8	79	79	74	79	72	63	75	82	90	88	68	65	69	31	23	54	55	53	53	56		
	Service Desirability	9	73	73	72	73	75	90	88	82	96	92	67	65	59	35	21	54	55	51	53	56		
	Average of 6-9	10	77	77	76	75	77	96	94	90	96	96	70	67	72	40	25	57	58	55	56	59		
Avg., Mktsp. & Exec. Comp. (average of 5 and 10)	11	88	88	87	88	89	92	90	88	92	96	96	76	71	77	46	21	62	64	60	61	65		
	Motivation Composite, Average	12	79	79	80	80	81	85	65	68	67	70	73	75	88	46	21	55	59	59	59	62		
	Executive Composite, Average	13	58	67	58	58	58	64	60	65	65	67	71	75	89	44	21	55	55	54	52	57		
	Avg., Mktsp. & Exec. Comp. (average of 12 and 13)	14	75	75	75	75	75	67	64	69	69	73	77	88	89	46	21	59	60	56	58	61		
	Motivation Composite, Average	15	50	50	49	52	51	40	35	37	39	40	46	48	44	46	47	45	45	45	45	48		
Executive Composite	Executive Composite, Average	16	26	27	27	26	27	24	23	23	21	25	27	27	27	27	47	26	26	27	24	27		
	Performance of Duty	17	62	61	62	62	62	56	52	54	52	57	62	58	55	59	45	26	87	87	88	95		
	Attitude	18	61	60	62	61	61	56	52	55	55	58	58	59	59	55	60	23	26	87	87	93		
	Bearing and Dress	19	60	57	62	61	61	53	49	53	52	55	60	52	52	54	58	45	21	87	83	85	93	
	Service Desirability	20	62	61	62	62	61	53	49	53	52	56	62	59	52	58	48	21	86	87	85	94		
Avg., Mktsp. & Exec. Comp. (average of 17-20)	Average of 17-20	21	58	60	55	65	65	57	53	56	56	59	65	62	57	61	48	21	95	93	93	94		
	Performance of Duty	22	45	44	45	44	45	21	37	41	39	42	45	41	39	44	31	19	61	59	53	57	60	
	Attitude	23	51	51	52	51	52	27	43	47	43	47	52	51	51	54	52	33	23	62	63	57	61	63
	Bearing and Dress	24	53	51	56	49	52	48	44	50	45	49	54	54	54	56	52	23	61	64	61	52	56	
	Service Desirability	25	47	47	48	47	48	41	37	44	42	45	42	46	41	47	32	18	62	61	56	59	62	
Avg., Mktsp. & Exec. Comp. (average of 21-25)	Average of 21-25	26	53	52	53	52	53	43	43	48	45	45	53	53	53	54	52	33	23	65	65	59	63	
	Motivation Composite, Average	27	61	60	60	61	62	55	54	55	58	56	61	58	58	57	57	23	23	70	80	59		
	Executive Composite, Average	28	50	52	52	51	52	45	42	42	47	47	52	57	52	58	42	25	53	53	52	51	55	
	Avg., Mktsp. & Exec. Comp. (average of 26-28)	29	48	48	45	45	45	48	21	29	28	29	32	33	35	36	35	15	26	26	25	24	26	
	Motivation Composite, Average	30	42	43	43	41	41	36	35	37	36	36	42	45	42	46	22	21	37	36	35	35	32	
Avg., Mktsp. & Exec. Comp. (average of 29-30)	31	40	39	39	39	39	35	32	32	32	32	32	32	32	32	32	21	21	31	31	30	30		
	Product	32	30	28	27	26	26	31	35	27	28	31	31	32	32	32	32	21	21	23	23	17	15	
	Marketing Courses	33	4	2	11	11	11	12	12	12	12	12	12	12	12	12	12	11	29	28	28	28		
	Service Engineering	34	21	24	26	25	25	12	12	12	12	12	12	21	21	21	21	19	32	32	32	32		
	Mathematics	35	14	17	18	17	17	21	21	21	21	21	21	17	17	17	17	12	36	35	33	32		
Avg., Mktsp. & Exec. Comp. (average of 31-35)	36	14	12	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	29	28	28	28		
	Electrical Engineering	37	14	12	11	11	11	11	11	11	11	11	11	11	11	11	11	11	29	28	28	28		
	Industrial Engineering	38	14	12	11	11	11	11	11	11	11	11	11	11	11	11	11	11	29	28	28	28		
	Physics	39	14	12	11	11	11	11	11	11	11	11	11	11	11	11	11	11	29	28	28	28		
	Chemical Engineering	40	14	12	11	11	11	11	11	11	11	11	11	11	11	11	11	11	29	28	28	28		
Avg., Mktsp. & Exec. Comp. (average of 36-40)	41	14	12	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	29	28	28	28		
	Marketing	42	14	12	11	11	11	11	11	11	11	11	11	11	11	11	11	11	29	28	28	28		
	Physical Training	43	14	12	11	11	11	11	11	11	11	11	11	11	11	11	11	11	29	28	28	28		
	Business Statistics	44	14	12	11	11	11	11	11	11	11	11	11	11	11	11	11	11	29	28	28	28		
	Business Law	45	14	12	11	11	11	11	11	11	11	11	11	11	11	11	11	11	29	28	28	28		
Avg., Mktsp. & Exec. Comp. (average of 31-45)	46	14	12	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	29	28	28	28		
	Business Math	47	14	12	11	11	11	11	11	11	11	11	11	11	11	11	11	11	29	28	28	28		
	Business English	48	14	12	11	11	11	11	11	11	11	11	11	11	11	11	11	11	29	28	28	28		
	Business French	49	14	12	11	11	11	11	11	11	11	11	11	11	11	11	11	11	29	28	28	28		
	Business German	50	14	12	11	11	11	11	11	11	11	11	11	11	11	11	11	11	29	28	28	28		
Avg., Mktsp. & Exec. Comp. (average of 31-50)	51	14	12	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	29	28	28	28		
	Business Spanish	52	14	12	11	11	11	11	11	11	11	11	11	11	11	11	11	11	29	28	28	28		
	Business Italian	53	14	12	11	11	11	11	11	11	11	11	11	11	11	11	11	11	29	28	28	28		
	Business Latin	54	14	12	11	11	11	11	11	11	11	11	11	11	11	11	11	11	29	28	28	28		
	Business Portuguese	55	14	12	11	11	11	11	11	11	11	11	11	11	11	11	11	11	29	28	28	28		

Nations Among Aptitude for Service Ratings by Executive Officers and Fellow Midshipmen on Five Different Occasions, Standings in Courses and Conduct, and Scholastic Aptitude Test Scores. Class of 1951 United States Naval Academy.

Aptitude for Service Ratings															Point & Class Standing in Courses & Subjects										School-Aptitude Tests																
Academic Year						Summer Training Period									2nd year 1949-50					3rd year 1950-51				4th year 1951-52																	
1st term, 2nd year Jan. 1949			2nd term 3rd year May 1949			1/c Cruise 1949		2/c Cruise 1949							3/c Cruise 1949-50		2/c year 1949-50		3/c year 1950-51			4th year 1951-52																			
3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42		
92	94	96	74	72	70	73	77	68	79	68	75	50	28	62	63	60	62	68	45	51	53	47	53	61	52	34	42	30	34	23	24	16	09	24	28	20	20	00	06		
89	93	95	75	73	70	73	77	58	79	67	76	50	27	61	62	59	61	68	44	51	53	47	52	60	51	35	44	28	19	14	27	09	05	22	24	20	20	00	06		
91	94	96	72	70	74	72	76	67	60	68	75	49	27	62	62	64	62	65	45	52	56	48	53	62	52	35	43	27	11	16	22	11	06	11	35	21	21	01	04	03	
91	96	74	72	70	73	73	76	66	60	68	75	52	28	62	63	61	64	65	44	51	53	47	52	61	21	35	45	26	11	16	15	11	07	10	29	21	21	02	03		
94	96	75	72	72	74	71	69	81	68	73	51	27	62	64	61	63	65	45	52	54	48	53	62	42	35	44	26	11	16	20	12	06	11	27	21	21	02	04			
72	74	75	88	83	80	86	92	56	60	67	60	26	56	56	53	54	57	46	47	43	44	42	55	45	26	36	31	16	14	06	09	27	12	22	21	21	03	06			
70	71	72	88	74	88	94	90	65	60	64	65	21	52	54	49	49	53	37	43	44	33	32	50	41	27	35	30	16	12	07	01	04	12	23	21	21	02	06			
74	70	72	33	78	82	90	88	68	65	65	65	22	54	55	53	53	56	41	47	50	44	45	55	46	29	37	27	10	11	06	06	05	12	25	21	21	01	02			
72	73	74	90	88	82	96	92	67	65	69	72	21	56	55	52	53	56	39	43	45	42	45	52	44	26	71	26	11	11	07	06	05	08	22	21	21	06	01			
76	76	77	96	94	90	96	95	70	67	72	70	25	57	58	55	56	59	42	47	49	45	49	56	47	29	38	31	16	13	07	05	12	26	21	21	03	04				
87	82	89	92	90	83	92	96	78	72	77	86	27	62	64	60	62	65	45	52	54	48	53	61	51	33	42	31	~	14	06	06	05	11	26	21	21	03	03			
80	80	81	65	65	68	67	70	78	75	88	48	27	58	59	59	59	62	41	53	54	66	50	53	57	35	45	22	16	21	12	14	14	16	27	21	21	01	07			
85	65	65	62	60	65	65	67	72	75	89	43	27	53	55	54	54	57	39	44	46	41	44	52	52	36	44	26	10	16	06	09	11	12	23	21	21	06	01			
79	75	75	67	58	69	69	71	77	66	89	46	27	59	60	58	58	61	44	51	52	47	51	59	56	36	46	24	13	20	09	11	13	13	27	21	21	03	05			
49	52	51	44	35	37	39	40	46	43	44	46	27	45	45	45	46	46	31	33	34	30	33	42	42	19	26	06	09	14	13	05	22	21	21	01	06					
27	22	27	26	21	23	23	25	27	27	27	27	27	26	28	27	26	27	19	24	23	16	21	25	29	16	23	10	08	09	75	07	03	09	11	21	21	21	01	03		
62	62	62	56	52	54	54	57	62	56	55	59	26	57	57	58	59	55	61	62	64	62	65	58	53	26	37	21	21	09	06	03	06	21	21	01	07	47	47	41		
62	63	63	56	54	55	55	58	62	59	55	60	28	57	57	58	57	59	59	63	62	61	65	62	53	25	36	23	09	12	06	06	04	06	18	21	21	01	02			
62	61	61	53	49	53	53	55	60	59	54	56	27	57	53	55	53	57	33	57	61	56	59	78	52	24	36	27	08	07	03	01	04	07	21	21	01	02				
62	64	63	54	49	53	53	56	61	59	54	59	28	58	57	56	56	58	57	63	62	55	63	60	51	24	35	15	02	03	02	03	22	21	21	01	02					
55	55	55	57	53	53	56	59	65	62	57	61	27	57	53	53	54	54	60	63	66	62	65	55	55	26	35	21	03	12	06	03	05	21	21	01	02	47	47	41		
65	44	45	41	37	41	39	42	45	41	39	44	21	31	39	51	59	53	57	60	66	74	70	52	67	27	30	27	23	12	04	03	06	05	21	21	01	03	47	47	41	
52	51	52	47	43	47	43	47	52	51	44	52	21	33	21	62	63	57	62	63	66	75	72	52	67	21	22	30	26	11	06	03	05	21	21	01	03	46	46	41		
56	53	53	48	44	50	49	49	52	52	46	52	21	34	23	62	63	61	62	66	75	74	54	67	21	22	30	26	11	06	03	05	21	21	01	03	46	46	41			
48	47	48	44	39	44	42	45	46	46	41	47	20	30	13	62	61	56	59	62	70	72	50	67	21	22	30	26	11	06	03	05	21	21	01	03	46	46	41			
53	52	53	48	43	48	45	49	53	50	44	52	21	32	21	65	65	59	62	66	72	76	55	67	21	22	30	26	11	06	03	05	21	21	01	03	46	46	41			
52	61	62	55	50	55	52	56	61	53	52	59	25	45	25	82	82	71	70	70	84	87	71	87	45	56	26	35	21	22	12	11	03	05	26	21	21	01	03	46	46	41
52	51	52	45	41	46	44	47	51	57	50	56	29	42	29	83	83	74	73	73	87	91	74	87	45	56	26	35	21	22	12	11	03	05	26	21	21	01	03	46	46	41
35	35	35	26	21	29	28	29	33	35	35	35	19	35	16	26	26	25	26	22	22	22	22	23	20	35	34	19	26	12	11	03	05	26	21	21	01	03	46	46	41	
43	43	44	36	35	37	36	35	42	45	44	46	23	38	23	37	35	35	35	27	30	30	35	32	36	62	4	21	20	11	11	03	05	26	21	21	01	03	46	46	41	
47	44	45	34	32	37	35	35	42	45	44	46	23	38	23	37	35	35	35	27	30	30	35	32	36	62	4	21	20	11	11	03	05	26	21	21	01	03	46	46	41	
47	44	45	34	32	37	35	35	42	45	44	46	23	38	23	37	35	35	35	27	30	30	35	32	36	62	4	21	20	11	11	03	05	26	21	21	01	03	46	46	41	
47	44	45	34	32	37	35	35	42	45	44	46	23	38	23	37	35	35	35	27	30	30	35	32	36	62	4	21	20	11	11	03	05	26	21	21	01	03	46	46	41	
47	44	45	34	32	37	35	35	42	45	44	46	23	38	23	37	35	35	35	27	30	30	35	32	36	62	4	21	20	11	11	03	05	26	21	21	01	03	46	46	41	
47	44	45	34	32	37	35	35	42	45	44	46	23	38	23	37	35	35	35	27	30	30	35	32	36	62	4	21	20	11	11	03	05	26	21	21	01	03	46	46	41	
47	44	45	34	32	37	35	35	42	45	44	46	23	38	23	37	35	35	35	27	30	30	35	32	36	62	4	21	20	11	11	03	05	26	21	21	01	03	46	46	41	
47	44	45	34	32	37	35	35	42	45	44	46	23	38	23	37	35	35	35	27	30	30	35	32	36	62	4	21	20	11	11	03	05	26	21	21	01	03	46	46	41	
47	44	45	34	32	37	35	35	42	45	44	46	23	38	23	37	35	35	35	27	30																					

APPENDIX

TABLE A

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